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THE NINTH ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

The Ninth Annual Meeting of this Society was held at the Tremont House, in Boston, on Feb. 19th. The meeting was very well attended, and the interest manifested shows very clearly that the institution is full of life and vigor. This Association is composed chiefly of those engaged in the practical management of works; and no stronger evidence of the great value of such meetings is needed than that furnished by the fact that each succeeding meeting is characterized by greater frankness, and a freer, more outspoken expression of opinion and experience by the members in the discussion of the various topics that come before it.

Although it is to be regretted exceedingly that there were no formal papers read, still the subjects presented were fully discussed, no doubt, with benefit to all. The great advantage of papers prepared beforehand is that those having facts to present are much more likely to present them in a clear and full yet concise way, when written out, than they are if mere notes or memory are relied upon. While we are perfectly well aware that one of the greatest benefits of gatherings of this kind is the opportunity it affords for comparing notes with each other, quietly, in a conversational way; still these facts and figures are not put on record for our subsequent study.

There was quite a long discussion upon the subject of statistics; and, with all due respect, it must be said that if the time spent in determining just who should have a copy of the tables this year, had been devoted to a healthy discussion of the conclusions that could be drawn from them, and the improvements indicated thereby, the practical results would be of much greater value. To speak plainly, we do not see that there could be any real harm come to any one if the whole table was to be published in the New York *Herald*, or any other paper. In fact, if there was more apparent publicity—less mystery—about the manufacture of gas, one great source of criticism on gas companies would be removed. Those days of mystery are gone, and one result is larger yields of better gas. The gas engineer has nothing to fear from the public, provided the public are properly informed. Who is the one best fitted to inform the public? Certainly, it is the gas engineer himself. His position is an honorable one, and he can make his influence felt in any community, if he will; but, in order to do this, he must not only possess intelligence, but he must use it. He must not only have information, but he must be ready, and know how, to impart it. Of course, it is not to be expected that he will tell everything he knows to every one he meets, for should he do this he would be unfit for any business. There is no mystery about real knowledge, and the dissemination of useful knowledge, and correct information, about any branch of business, must tend to enlarge it and facilitate the transaction of it. Under the legal restrictions governing the gas business in England, most of the companies there are required by law to publish statements of their business; and the evil resulting from this remains to be discovered. When the law in this country will give to gas companies here the same protection that it does there, no gas engineer could reasonably object to the publication of his results.

There was one action taken at the meeting last week, with reference to standard burners, that is most important; and it is to be sincerely hoped that it will be followed throughout the United States. For purposes of *comparison of results among themselves* it was voted that the members should use the Sugg Standard London Referees Burner, as certified by the Board of Trade for 16 candle gas.

This is a step in the right direction; and the burner selected is the most appropriate one, inasmuch as the average illuminating power of the gas sold is about 16 candles. Of course, every man is entitled to use that burner that will give him the most light from a given quantity of gas consumed; but when two or more men come to compare results, they must have a common standard of comparison, in order to understand what basis they are reasoning upon.

There are some points regarding the flat flame burners that we hope to give our readers some information upon at an early day; but the New England Association is entitled to great credit for declaring what standard they shall use for purposes of comparison among themselves. Our official report will give the details of the other discussions that were held.

In the evening the members dined together in the hotel, and after the repast was over the usual toasts were drank and speeches were made.

On Thursday morning an informal meeting was held at the Superintendent's office of the Boston Gas Works. The subject of burning tar, and the arrangements for future meetings were discussed.

After visiting the works the members separated, and returned to to their homes well satisfied that such meetings are of great value to those who attend.

[From the "International Review."]

Gas Stocks.

Gas Stocks have suffered a sudden fall in market value, and electricity is generally regarded as the cause in producing this depreciation. It will be interesting to examine the grounds of the popular belief that electricity is about to revolutionize our methods of illumination, and that it is the agent by which gas stocks have lost their high place in regard to investments. The first practical questions to be answered are in reference to the generators of the electric current by which the electric light is produced; are they efficient in themselves, and can they produce an electric light which will be cheaper than gas light of equal intensity? The writer has found among business men a great deal of misapprehension in regard to these generators of electricity, commonly called dynamo-electric machines. Many think that they resemble the frictional electrical machines which they once saw at school, and that the electricity is a fluid or substance which is to be conveyed in pipes, just as gas is at the present time. In a general manner, we can say that these generators all depend upon the principle that when a wire which forms a loop of any figure whatsoever is revolved rapidly near a magnet or magnets a current of electricity is generated in the wire. We can revolve the wire near the poles of a magnet, or the magnet near the wire, and in both cases a current is generated.

Theoretically, all motion can be changed into heat. This is the now commonly received and well-known doctrine of the conservation of force. When an express train is suddenly stopped, the motion heats the breaks. When a cannon ball is stopped by the plates of an iron-clad, it is often heated to the melting point. Electricity has its exact equivalent in heat, and it seems logical to say that motion can be entirely changed into electricity. Theoretically this is true; and practically by the revolution of a wire in front of the poles of an electro-magnet from 70 to 80 per cent. of the work required to produce the revolution is changed into electricity.

These new generators are already so complete that it is proposed to utilize natural forces in a more general manner than has been done hitherto; for instance, to place one of these dynamo-electric machines near a waterfall, and transmit the current over wires to a more available point, and there set another dynamo-electric machine in motion, which shall furnish power or light, just as desired. This statement is within the bounds of possibility; it has been found to be perfectly possible to transmit motion in this way. The electric currents produced by these new machines are immense, and far exceed those which are created by the old method of Voltaic elements or batteries; the most refractory substances are melted in the heat of the Voltaic arc, and immense wires are needed to convey the current, for small wires of considerable length are immediately fused by the great heat developed.

Understanding, therefore, that the new generators of electricity require steam engines to drive them; that the method is to revolve coils of wire in a magnetic field—that is to say, in the presence of electro-magnets; that the current differs in no respect from that used in telegraphy except in strength; that it must be and is transmitted over wires or large metallic conductors, and that all motion can be transformed into electricity—we are prepared to begin our inquiry.

In the first place, granting that we have the best generator now before the public, what will be the methods of the new system of electric illumination? Let us confine ourselves, at first, to the case of single buildings or large halls, and rooms in manufactories. The first step is to obtain a steam engine, which shall furnish about 1½-horse power to each electric light or burner, if the electric light is formed between carbon points, as in the present system. There are over two hundred manufactories on the continent of Europe which are lighted by electricity, and the general statement is that the light costs one-third as much as the same amount of light produced by gas. The reader can find many estimates of cost in the work on electric illumination by Hippolyte Fontaine, and in the new work by Schellen on dynamo-electric machines. In general these estimates appear to be fair ones, cover all the items of expense, and include estimates of deterioration and interest on first cost. It can not be doubted that for certain purposes and certain localities electric illumination is cheaper than that by gas. This statement, however, needs to be carefully considered, for we cannot conclude that because electric illumination is cheaper for certain manufacturing operations, it is also suitable for all localities, and can compete with gas for general purposes. The light has only been successful in large enclosures like railroad depots, foundries, and manufacturing establishments with lofty ceilings. There is difficulty at present in adapting it to low-studded rooms, such as weaving rooms in cotton mills; still, this difficulty is not insurmountable. The light appears to be making its way into use in localities and manufactories similar to those we have mentioned both in Europe and in this country. In general, the generators in this country are now placed in mills or large establishments merely on trial, at the expense of the companies which are introducing the electric light. Very few corporations have taken any risks at present in the introduction of electric illumination. The moneyed interest are much more cautious than the general public, and less ready to believe in the success which newspapers blazon forth. Resting, therefore, upon what is already secured, it cannot be denied that the electric light supplies a deficiency, and is already introduced successfully in certain localities and for certain purposes. A large foundry, a large exhibition hall, a depot, can all be lighted economically by the electric light. We must not forget, however, that frequently more light is obtained than is really necessary. It is as if we lived in an immense palace, which we have hired at an extremely cheap rate, and which gives us far more accommodation than we need.

The above remarks are based upon the present system of lighting, in which a steam engine of 6 or 12-horse power is required to maintain 6 to 12 lights. We shall presently consider what is called the subdivision of the electric light—in other words, the production of many lights of intensity not far from that of two or three ordinary gas burners. At present all that has been practically accomplished is the perfection of the generators, and the production at 6 or 12 points in the electric circuit of 6 or 12 electric lights between carbon points. These lights are individually as well as collectively very intense, and suitable only for lighting great areas.

It is the custom in many places abroad to use the electric light for a portion of the time—for instance, to use what is called the Jablochkoff candle, which consists of two carbons separated by a substance which melts away as the carbons burn, for two or three hours—and then to use gas. In this way there is no doubt that one light can advantageously supplement the other. In our rapid review of what is assured at the present time we have endeavored to divest the subject of imaginative possibilities. It is commonly thought that Paris has been and is lighted by electricity; this is not true. During the time of the Exposition there were many electric lights in and about the buildings and in the neighboring buildings, but nothing like the general lighting of the city was accomplished. This was prevented, not by the power of monopolies or prejudice, but by practical difficulties which we shall have occasion to speak of.

With the best system of electric illumination now before the public, it is not possible to light city streets or dwellings. By lighting is meant the actual illumination by means of electricity without the aid of gas. The use of this new method of illumination is therefore confined to certain narrow limits. "But," it may be said, "will not the consumption of gas be necessarily less if large manufactories in cities adopt the electric light, and will not this tend to depreciate gas stocks?" Granting that a large number of great manufacturing establishments, hotels, and theatres should abopt the new light, we should say that gas stocks would suffer from this cause; but there are certain limitations to be borne in mind. There are not a large number of buildings which run a requisite number of hours to realize the economy of electric illumination, for time is also an element in the calculation of the saving made by the adoption of the new light. In the city of Boston it is estimated that from 10 to 15 per cent. of the daily consumption of gas arises from the large manufactories, hotels, and theatres, which have not yet to any extent (there are two establishments lighted by electricity) adopted the light; and it is not probable that there will be this adoption even for several years—certainly not unless some better lamp or electric light apparatus is devised. The number of large manufacturing establishments, depots, or great halls in a city or town, therefore, is an element in our estimation of the possible effect of the electric light on gas stocks. In a manufacturing town like Lawrence or Lowell gas stocks might suffer if the electric light really made its way to any considerable extent. Especially where water power is cheap would this be the case. It must be remembered, however, that water power is not necessarily cheap in large manufacturing places like Lawrence, which are in the centre of a thriving, bustling community. And it is not possible to consume additional power in running electric generators without proportionate expense. There are also certain business relations between mills, gas companies, and city corporations, which make the introduction of a new system of lighting extremely difficult in many places. At the present time, therefore, we can not say that what has been done should have affected gas stocks.

Let us now see what are the possibilities of electric illumination. The largest consumption of gas arises from dwelling houses in cities. It is the small burner multiplied over great areas, which, like a low rate of interest, gradually produces great results. It is estimated that the city of Boston consumes only about 10 per cent. of the daily amount manufactured, and the largest part of this is burned in street lamps. If, therefore, a suitable electric lamp for streets should be devised we might, if there were no such things as monopolies or personal interests in the matter, begin to fear a little for our gas stocks. Supposing that a suitable lamp, giving the light of five or six of our present street lamps, should be invented, and that

twenty of these could be maintained by one generator. It would be necessary to place steam engines of 10 or 15-horse power every few blocks, and even this future success must be accompanied by the discovery of some economical method of insulating and conveying the wires over which the electric current flows. It has often been proposed to convey the telegraph wires, which enter a city in such great number, underground. but this has not proved practical, and we should therefore also have to maintain massive conductors above ground until it can be shown that there is some economical method of insulating underground. We can not affirm that new generators requiring less horse power may not be invented which will maintain small lights suitable for street illumination, or that one engine of immense horse power may not economically generate sufficient electricity to illuminate a large extent of city space.

Nothing has been accomplished yet in this direction, and from a logical point of view it would be just as reasonable to dispose of our interest in a water privilege for fear of a new magnetic motor as to dispose of our gas stock for fear that a new application of electricity would light our streets, for in both cases nothing definite has yet been realized. Even if such a new invention or method could be applied to street illumination, the equivalent of gas saved is only from 10 to 15 per cent. of the total consumption.* Electricity must therefore enter into competition with gas in dwelling houses, and in all places where small burners are employed, in order to seriously affect our gas stocks. What steps have been taken in this direction? We are sorry to answer "none," at this present writing, for Mr. Edison has not made his plans public. The plan of that inventor, together with that of many others, is to produce small lights by the incandescence of platinum wire, or of wire made of platimum and iridium. Dr. Draper, of New York, in his Scientific Memoirs, Feb. 27, 1847, states that a surface of platinum of standard dimensions, raised to a standard temperature by a Voltaic current, will always emit a constant light. A strip of that metal 1 inch long and 1-20th of an inch wide, connected with a lever by which its expansion might be measured, would yield at 2,000° a light suitable for most purposes."

It is well known that Mr. Moses G. Farmer, of the United States Torpedo Station at Newport, R. I., has for many years experimented upon the light produced by the incandescence of both of these metals; and many also in Europe have endeavored to overcome the difficulties in the method. The incandescence of the wire produces a beautiful light; but the wire fuses at a certain point, and the light is interrupted. The difficulty is in making an automatic regulator which shall maintain the wire below the point of fusion. It is claimed that Mr. Edison has accomplished this. Granting this, although there is no proof before the public, it must be borne in mind that each light would require a comparatively delicate piece of mechanism instead of our simple gas cocks, and that wherever an electric circuit is divided, or, in other words, wherever the incandescent wire is introduced, if the current is diminished to, say, one-hundredth, the light is reduced to one ten-thousandth, or as the square.

Attempts have also been made to produce the electric light by the incandescence of strips of carbon placed in receivers which have been exhausted of air, or in receivers filled with nitrogen. The difficulty in this method is to prevent the gradual disintegration of the carbons. This is not a new method, but was experimented on in Europe as early as 1845. It is said that the preparation of the small carbons which are necessary is expensive.

In our present method of illumination we have a meter, which gives a comparatively accurate method of determining the amount of gas which we burn. Many stories can be told of its sometimes absurd registration, or of its peculiar interpretation by agents of gas companies; but on the whole it answers its purpose. If lighting by incandescence of platinum wire is a success, how shall we measure the light? There is no known method at present. It may be answered that some plan of subscription will be found effectual, and just as our water supply is taxed by the number of faucets, so will our electric lamps be taxed. We cannot, however, compare a water supply with that of electricity; for the generation of electricity is limited, and if one person or one corporation is lavish, it is at the immediate expense of the rest of the subscribers.

Granting that a meter also has been invented in order to introduce electric illumination into houses, we must establish steam engines—at least one for every twenty ordinary city houses, with all their concomitants. The imagination immediately takes a flight, and suggests, "Why not heat your houses from the same source, or from the electrical current, for there is an immense waste in the present system of each family maintaining a furnace." Steam, however, cannot be economically conveyed great distances without losing its heat, and although it is possible to heat water by electricity, it would not probably be economical to first partially convert the energy of a pound of coal into steam, and then convert the energy derived from this steam into motive power, and finally to convert the motive power into electricity and heat. Nothing practical has been done in this direction, although the imagination suggests great possibilities.

We are forced unwillingly to confess that no progress has been made in the introduction of electric illumination into dwelling houses, and granting even that Mr. Edison has solved the difficult problem of dividing the light, he has other problems fully as difficult to solve before the light can compete with the simple method of illumination by gas.

We are forced to believe that if the present decline in gas stocks is based upon what electricity has accomplished, there must be a reaction, for there is nothing at present in electric illumination which can seriously affect the consumption of gas in cities like Boston or New York. We have looked into the subject from an electrical point of view, and it is not the purpose of this paper to inquire into the cause of the present fall in gas stocks. The causes are undoubtedly many—a feeling of insecurity in all investments, sympathy with the decline in other stocks, and last, but not least, the competition with kerosene and gas made from it. It is possible at the present time to make a large saving by the use of kerosene in dwelling houses; and it is claimed that large establishments can be lighted by what may be called kerosene gas at a far cheaper rate than by coal gas. It is certain that public attention is directed to new methods of employing petroleum, and the chances seem to be better in this direction than in that of electricity. There is certainly less danger from the electric light than from gas or kerosene; but practice controls even the most dangerous elements.

It is difficult to steer between the skepticism of scientific men and the unbounded credulity of those who know nothing of electricity. The latter believe that we are on the verge of greater discoveries than the world has ever seen, and electritity to them is capable of all things. On the other hand, the scientific man perceives the difficulty of scientific investigations, and finds the first great glow of enthusiasm at some discovery so often succeeded in his own case by limited possibilities, that he is trained to be critical, and to believe that in ninety-eight cases out of a hundred his discoveries will have no appreciable influence on mankind. At times the skepticism of scientific men has been excessive. Sir Humphrey Davy laughed at the project of lighting the city of London by gas, and satirically asked the projectors why they did not take the dome of St. Paul for a gasholder. In those days, however, we are inclined to think that the general public was more skeptical than the scientific men; it took from 10 to 15 years to introduce gas lighting into London.

*In Boston.

[Copy of Report kindly furnished by Mr. Bennett.]

The Electric Light at Westgate-on-Sea.

Report by Messrs. W. H. Bennett and W. A. Valon.

Edmund F. Davis, Esq., St. Peter's, Isle of Thanet.

Sir:—Having received an intimation from you, in the middle of September last, that you were desirous of having an exhibition of the electric light upon your estate at Westgate-on-sea, with the view of ascertaining whether the light is practically adapted to public lighting, and its cost, and, having subsequently received from you instructions to make arrangements for such an exhibition, we put ourselves in communication with the representatives of the various systems then before the public.

The system at that time attracting public attention the most was one that apparently displayed the greatest power of light per lamp, and to its agents we therefore resorted. Upon making known our wishes, we were informed that such an exhibition would be very expensive, that they were inundated with applications of the same kind from all parts of the country, that they had no machines at liberty, that the machines were being made in France, and that they expected to receive 50 of them in the course of that week, and that possibly, if we applied again in a fortnight, they would be in position to entertain the application. Accordingly, after a lapse of a little over a fortnight, we again waited upon them, when another representative repeated in the blandest manner almost the identical story we had heard before, with this variation, that if one of us would call again at the end of a week, it was possible they might be able to say something more definite. After considerably more than a week, one of us did call again, to hear a repetition of the previous narration in somewhat more shadowy terms. In the meantime, we had applied to the representatives of other systems. On stating our wants to the one of these, whose light appeared to possess features more recommendatory than either of the others, we were very courteously and candidly told that, while the inventor would be most happy to invite us to witness experiments about to be exhibited, the details for making the invention applicable to a number of public lights were not sufficiently advanced to justify the acceptance of such an engagement. On applying to the agent of another system, we were met with a refusal in terms so curt as

to leave us in painful doubt as to whether it was the greatness of the invention or the agent that induced such a display. It would have been unnecessary to enter upon these particulars, but for the apparent great loss of time in carrying your instructions into effect. However, we ultimately arranged, with your consent, for the supply of machines, cable, six electric lamps upon the Jablochkoff candle principle, all the electrical appliances connected with the proposed exhibition, and the requisite attendance, you supplying motive power and such local assistance as would be needed.

The site selected by us, and approved by you, for the exhibition of the lamps, is called the Sea Road, which runs between the ornamental gardens in front of the sea on the one side, and a number of villa residences on the other side. Here the positions of six lamps were marked out, the first being placed at a point where four roads meet, and the rest at a distance of 80 yards apart from each other, the distance between the two extreme lamps being 400 yards. Lamp posts, 9 ft. 6 in. in height, corresponding to these positions, were therefore erected close to the railings of the ornamental gardens. An unoccupied building site on the residential side of the road, next to the premises of the Westgate Club, and situated about midway between the extreme lamps, was taken advantage of for the erection of an engine-shed, in front of which a portable office, used by the Clerk of the Works on the estate, was placed, and converted into a very convenient room for the reception of the machines. A portable steam engine, with horizontal boiler, and of 10-horse nominal power, made by Messrs. Garrett and Co., was temporarily fixed in the engine-shed, and a countershaft, with suitably sized riggers and bands, to give the requisite velocities to the machines, was firmly secured to a foundation prepared for it. The two Gramme machines emplcyed are now sufficiently well-known to need no description of their details here. Suffice it to say that the small one was used to produce a direct current to excite the large or alternating current machine, the latter being of the size known as a six-light. The arrangement of the machine is such that two distinct and separate currents can be drawn from it, and it is desirable that the circuits shall be as short as possible, and being anxious to make the experiments a success, we determined to divide the current, and use two circuits, putting three lamps upon each circuit. The cables leading from the commutators in connection with the machines were taken in 2-inch pipes, laid beneath the surface of the road, to the nearest lamp-posts, the cable or wires connecting one lamp to another being laid on, and attached to the railings of the ornamental gardens before referred to; the return wires following the same course back to the machine. The lamps were similar to those used in Paris to light the Place de l'Opéra, the Aveuue de l'Opéra, the Magasin du Louvre, etc., each being adapted to receive four electric candles, and each candle being alleged to be capable of burning an hour and a-half. One man was engaged to drive the engine, and another, specially qualified, to look after the machines and attend to the lamps.

On the 30th of November the arrangement of apparatus and lamps was, though not complete, sufficiently advanced to make a preliminary trial, and three lamps were lighted, and continued to burn for an hour or two successfully.

On Monday, the 2d of December, a party of gentlemen connected with the London and Provincial Press, and others interested in the snbject, assembled in front of the engine-shed, and at a quarter past five o'clock the whole six lamps were lighted almost instantaneously. The effect was most gratifying, and from this moment the experiment may be said to have commenced.

The lamps continued to burn brightly till eight o'clock, when the three on No. 1 circuit were suddenly extinguished, and, on the attendant going to examine No. 1 lamp of that circuit, he found the wires were disconnected from the binding screws immediately below the globe. It is presumed that some one, prompted by more curiosity than wisdom, fingered or pulled upon these wires until one became disconnected, when the continuity of the circuit was temporarily destroyed, and the whole of the lights on it, of course, went out. An attempt was made by the attendant to relight the lamp by diverting the current to another candle; but, on putting the key to the commutator-box, he received such a shock that the key was jerked to the other side of the road. The manager of the gas works at Birchington, that supplies Westgate, was present, and endeavored to re-adjust the current, but received several shocks sufficiently strong to impress him with the desirability of postponing further effort until daylight would lend its assistance for the replacement of the wires. Owing to the inability of the attendant to be in two places at once, and the mishap just mentioned, he omitted to shift the current from the expiring candles to fresh ones on No. 2 circuit, and the consequence was that at 8.30 they went out too. The evening being so far advanced, it was not thought worth while to relight either series.

It is unnecessary, in a report of this kind, to give the particulars of each night's burning, and we, therefore, summarize them by saying that the lamps were continued alight generally for four hours per night for 24 nights, and, with the exception of Sundays, Christmas Day, and the following day, consecutively. The total number of hours during which the lighting was continued was 93¼. This is equivalent to a little over the time that gas lights would be burning for six nights at the present season of the year. The time during which the lights should have continued burning was 96 hours, the difference being due principally to the charge of four candles not lasting the full time of four hours per night. It is desirable here to mention that, although it is alleged each candle will burn for an hour and a-half, and, although it has been found that, on some occasions, they will last that time, still, in practice, in order to reduce the liability of the candles being extinguished, it was found unsafe to neglect the changing of them nearly every hour. This precaution, however, was not sufficient to prevent the lights from going out incidentally, and upon eight occasions this effect took place. We are inclined to think that this was due mainly to faults in the candles, and we are fortified in our supposition by those who have had more experience, that at times minute cracks will occur in these carbons, either in their manufacture, packing or transmission—that these cracks are almost imperceptible, but when the candle has burnt down to near the fracture, the energy of the current, instead of throwing off the carbon in minute particles, forces off a piece of such magnitude as to increase the distance between the carbons, and the resistance thus occasioned is more than the current will overcome, consequently the arc is destroyed, and the light fails.

It is quite certain that, however much the carbons have been improved, their homogeneity is still defective; for, while continuing to burn, one frequently perceives pieces of carbon thrown off from the candle to the bottom of the globe, and this always occasions a considerable variation in the light. The number of candles used in the 24 days was 586; but we are inclined to think that, if we had been upon the spot the whole time, some economy might have been effected in this respect.

The disadvantages arising from a sudden failure of any one light are, firstly, that the whole of the lights on that circuit are extinguished, and although they may have been burning but a few minutes, the necessity for changing to fresh candles is imperative; the candles only thus partially burnt become useless, and as a consequence increases the expense of this system of lighting. Secondly, the attendant, though engaged at one extremity of his district, may be compelled to go immediately to the other for the purpose of changing the candles, and until the whole of the candles in the faulty circuit are changed, and the continuity of the current completed, absence of light must be the result. In your case, where the distance between the extreme lamps was but 400 yards, the inconvenience was comparatively trifling; but, even there, such a change involved continued darkness for five or six minutes. and it is not difficult to predict many of the dangers that would arise from a crowded thoroughfare being kept in darkness for even five or six minutes. Of course, the more the number of lamps on each circuit is increased, and the longer the distance the man has to travel, so will this evil be augmented. It is true that it is possible to place the man centrally, and give him command over the whole of the lamps from this point, but the great cost of providing cable sufficient to make this plan practicable renders its adoption almost prohibitory. As it was, over 1190 yards of cable were used. Nothing, however, will prevent the necessity of an attendant having to visit the lamps every four or five hours to insert fresh candles.

You will perceive from the foregoing that to light a town or a large area under this system it would be necessary to have a considerable number of stations, each of which would have to be provided with complete machinery and apparatus. Nor is this all, for it is equally imperative that the whole of the machinery should be provided in duplicate, because machines of every kind require repairs from time to time, and a failure of even an hour's service would never be tolerated by the local authorities or the public. We are aware that commentators upon this system have never insisted upon the necessity for furnishing the apparatus in duplicate, and the promoters of electric lighting say it is not needed; but those who are better acquainted with the requirements of public lighting know that it is absolutely indispensable. Even with duplicate machinery and apparatus, unless an arrangement could be made so that the stopping of any machine should automatically set the substitue in motion, all the lights in connection with that machine would be extinguished.

The steam-engine, as before stated, was a portable one, of 10-horse nominal power, with a horizontal boiler, and having a cylinder 12 inches in diameter and 12 inches stroke. It was worked with an averags pressure in the boiler of 53½ lbs., and made 126 revolutions per minute. This gave a velocity of 959 revolutions per minute to the large machine, and 1263 to the small one. Towards the close of one evening's experiment, the governors were thrown out of action, and the full force of steam in the cylinder was intentionally and gradually lowered to 21 lbs., when the lights went out,

On another occasion, when a similar experiment was made, the lights went out when the steam had been lowered to 25 lbs. We must regret that the engine was not adapted for the application of an indicator, whereby the actual indicated horse power required to drive the machines might have been ascertained. It is, however, evident from the above that the full nominal horse power was absorbed; and it is to the abundance, though not superabundance of the power at our disposal that we attribute in a great measure our success in keeping the lamps so constantly alight.

As one of the objects of this exhibition was to determine the cost of this method of illumination in comparison with that of gas, as ordinarily employed, it became our duty to ascertain the illuminating power of the electric light. To do so fairly, we resolved to make the experiments *in situ*. Accordingly, lamp No. 6, the last in No. 2 circuit, was selected, it being more conveniently situated for such a purpose. At a distance of 84 feet from the electric light, and at nearly right angles to the general line of the electric lamps, a lamp-post of the same height was erected. To this was fitted an ordinary 14-inch lantern, furnished with a perforated zinc bottom, and provided with an arrangement within for the prevention of undue draught. One of Sugg's Argand burners was selected as a standard, and was tested in the lantern in which it was to be employed. With gas at a pressure and of the quality at our command, we found it yield a light equal to 25 candles, as indicated on the photometer-bar, and subsequently corrected. It is possible that some may object to this standard, on the ground that it is evident that we did not burn the gas to the best advantage. This we foresaw, but it was quite immaterial for our purpose whether the standard gave 25 or 50 candles, so long as we preserved an uniform and steady flame, and knew precisely what the value of our standard was, and we therefore adhered to it. A stationary platform was erected in a line with the two lamps, graduated into feet and inches, and upon this platform was a smaller and moveable one. On the moveable platform was placed a modification of Leeson's star disc, 10 inches square, and made specially for the purpose, surrounded by a blackened wood screen, but open at the ends, and with an opening also in front through which to view the disc. The screen was mounted upon wheels that ran upon rails fixed to the movable platform, and had fastened to it a pointer that descended to the stationary platform, and in front of the graduations. The moveable platform thus served for a rough adjustment, while the disc was capable of being removed to and fro, and adjusted with great nicety.

The lanterns or globes first supplied were 17 inches in diameter, and subsequently several additional ones were sent, in case of breakage; amongst these was one of 20 inches. Breakage of the globes did take place, and so long as we had 17-inch ones to replace them, we maintained uniformity; but ultimately we were obliged to use the 20-inch one, when there was such a manifest increase in the quantity of light from the larger globe, that it attracted the attention of almost every observer. We, therefore, applied to the light to be tested the 20-inch globe. The average illuminating power was ascertained, from a great many readings, to be equal to 197 candles, the variations, which were incessant, ranging from 192 to 207. We also tested the light with the 17-inch globe, but the results were so inferior in power that we rejected them as unfair for comparison. We are sorry that at no time when we were present, and prepared to take the illuminating power of the naked light, could we do so, on account of the violence of the wind; in fact, the whole of the time during which the exhibition lasted the weather was very inclement. Although the wind did not actually put it out, the light was so reduced that any attempt to test it would have been useless. This, though a matter of regret in some respect is of no very material importance, since all comparison between it and gas for public lighting purposes must be made with the electric light covered, because the light without such a softening and diffusing medium would be, if not insupportable, at least most disagaeeable to the eye.

We now approach the subject of cost, and propose to show the actual working expenses you would have had to pay for the 24 days' exhibition, supposing that you had to pay each item yourself, instead of paying an agreed price to a contractor—

	£	s.	d.
Fuel for engine	7	1	2
Water		3	6
Oil		10	0
586 candles, at 8d each	19	10	8
Engine driver, 5s. per day for 24 hours	6	0	0
Machine and lamp attendant, 6s. per day, 24 days	7	4	0
Total working expenses	£40	9	4

for maintaining a light of 1182 candles for 93½ hours actually but say 96 hours.

Now, supposing the same light had to be obtained from gas for the same time, and suppose the price charged for it was 6s. 6d. per 1000 cubic feet, as at Westgate, we shall find (assuming that 5 feet of gas, of the quality supplied there, burned in an ordinary street lantern, gives 11 candles) 1182 candles divided by 11 is 107½, or the number of gas-lamps necessary to equal the six electric lights,

Therefore	107½	lamps
Multiplied by	5	the number of cubic feet consumed per hour,
	537½	
Multiplied by	4	the number of hours per night,
	2150	
Multiplied by	24	the number of days,
	8600	
	4300	

Produces 51,600 cubic feet of gas, which, at 6s. 6d. per 1000, comes to £16 15s. 4d., and would be the cost of exhibiting an equal amount of light to that produced from the six electric lamps for the same time—£16 15s. 4dd. for gas, as against £40 9s. 4d. for electricity.

Although it may be perfectly justifiable to charge 6s. 6d. per 1000 for gas at Westgate, it must be admitted that that price is a very high one. Had the experiment been made in London, the following figures for gas, in comparison with electricity, would have been the result:

Gas being of higher quality at London than at Westgate, 94½ lamps would yield an equivalent light—therefore, $94\frac{1}{2} \times 5 \times 4 \times 24 = 45{,}360$ cubic feet, which at 3s. 6d. (the average price in London), would be £7 18s. 9d. for gas, as against £40 9s. 4d. for electricity.

It is a curious fact, and one well worthy of remark, that had the cost of the fuel, oil and water, namely, £7 14s. 8d., been expended in gas at the average price charged in London, it would *very nearly* have purchased an *equal* amount of illumination.

Let us see now what would be the cost of establishing and working six electric lamps for one year, of 4327 lighting hours, upon the basis of the first figures quoted above:

	£	s.	d.
Boiler-house, engine, and machine-room	300	0	0
10-horse engine and boiler	300	0	0
Duplicate	300	0	0
Pair of Gramme machines	220	0	0
Duplicate	220	0	0
Cable, 1100 metres (*i. e.*, 1190 yards), at two shillings per metre fixed	110	0	0
6 lanterns, with their accessories	60	0	0
6 lamp-posts	12	0	0
Total	£1522	0	0
10 per cent. interest on £1522	£ 152	4	0
10 " depreciation on £580, the cost of one set of machinery and lamps	58	0	0
Fuel	318	2	9
Water	7	17	9
Oil	22	10	8
26,412 candles, at 8d	880	8	0
One man to drive engine and attend to the machines, at 6s. per day	109	10	0
Attendance to lamps, at 5s. per day, upon the supposition that one could attend to 20 lamps	27	7	6
Cost of supplying 6 electric lights for one year of 4327 lighting hours	£1576	1	3
Or 14·56d. per light per hour			

This includes no allowance of interest for working capital, or depreciation of buildings or cables.

It may be well to observe here again that the promoters of the Jablochkoff system state that each candle is calculated to burn an hour and a-half. We have not found this borne out in practice; but assuming that they would do so, the candles would still cost no less than £535 15s. 4d.

On turning to see the cost of supplying the same illuminating power with gas, we shall find the 1182 candles, or 107½ lamps, multiplied by 5 cubic feet, multiplied by 4327 lighting hours, gives 2,325,762 cubic feet, which, at 6s. 6d. per 1,000, the price charged at Westgate, comes to £755 17s. 4d. Add to this, 13s. per lamp per year for lighting, cleaning and repairing, £69 17s. 6d., and we have £825 14s. 10d., or above £54 less than it would according to our experience cost for electric candles alone.

This same amount of light for the same time, at the average rate charged for gas in London, including lighting, cleaning and repairing, would amount to only £427 13s. 3d., and, by the apparently improved system about to be inaugurated, probably less.

Before quitting this part of the subject, it is only right to draw attention to the fact that, while we can measure very accurately the intensity of any given light, there is no known means of measuring its quantity. Now, the electric light is a light of great intensity, but possessing very little quantity; and, as quantity is a necessity for good illumination, it is almost impossible to draw a correct money value comparison between electricity and gas. It needs no technical or scientific knowledge to see that, if 1182 can-

dles, or their equivalent, 107½ gas-lamps, had been spread over the same area as the six electric one were, there would have been a far more brilliant and agreeable illumination than existed during our experiments. We should have been glad to have demonstrated more fully the merits of gas in comparison with electricity, and were prepared to submit to you a plan for that purpose; but the unfavorable time of the year would not warrant such an expense as would have been entailed, and we therefore abandoned the idea until a more suitable season.

In drawing the report to a close, we should remark that, while the exhibition of the electric light at Westgate, as an electric light, has been most successful, and every effort has been made by us to give the system the fairest possible trial, we say, with the greatest confidence, that this method is surrounded by so many practical difficulties, that no amount of improvement is likely to fit it for general adoption. The liability of the machinery to derangement at any moment, the defective character of the candles, the incessant variation of the illuminating power, want of diffusibility and means of storage, the constant care and attention the lights require, and the enormous cost of producing the light, all unfit it for a general public illuminating agent. We have seen all the systems that have been introduced within the last 18 months, and we have no hesitation in stating that if electricity is to be the light of the future it must be produced by a radically different system to any yet brought before the public—a system, in our opinion, that remains undiscovered.

We trust that the public, and especially those who are connected with gas, will appreciate the spirit you have shown in affording an opportunity for investigating this method of illumination—an investigation that has materially assisted us in coming to the conclusion, that the introduction of the electric light, though destined to survive but a short time, will go far to promote the increased use of gas, and consequently the prosperity of gas interests.

We are, Sir, yours faithfully,

W. H. Bennett,
William A. Valon.

22 *Great George Street, Westminster, S. W., Jan.* 17, 1879.

[From the "Manufacturer and Builder."]

A Warning to Plumbers and their Patrons.

Diphtheria, scarlet fever, and pneumonia have been particularly active in certain parts of New York and Brooklyn during the past year, and the cause is criminal carelessness, official stupidity, and extraordinary recklessness on the part of property owners, and of builders and plumbers.

Although the life of a person in ordinary circumstances is of as much value as the life of a millionaire, it is quite natural that the latter, dying in a costly mansion, where money has been lavished on devices for protection and comfort, should attract the greater attention, especially if it were a reasonable inference that sewer-gas was in any degree a predisposing cause. Fortunately the death of the late Mr. Rockwell was brought to the authorities, and the result of an official investigation is most surprising.

On Brooklyn Heights live many of the wealthiest and oldest families in Brooklyn. Furman street runs along the river front, and is on low ground, occupied mainly by warehouses, car tracks, and cheap tenement houses. On the heights above it, and adjoining other streets, are located the homes of wealthy families, the principal churches, also the principal young ladies' seminary, formerly the Female Academy, now called Packer Institute. In this district a great number of children, and not a few adults, have been carried of by scarlet fever, diphtheria, and pneumonia. When Mr. Rockwell's family began to die, and one after another was carried to Greenwood, public attention was attracted to the several possible causes of this extraordinary fatality, but no one dreamed that the death-trap was the trap in the millianaire's costly but worse than useless plumbing.

The Sanitary Superintendent of Brooklyn examined the pipes and general plumbing, assisted by an expert. Among other things they found that some of the main lines of soil-pipe that are continued to the roof, do double duty—carrying off the sewer-gas and acting as rain leaders. One of the pipes receives the water from 1,200 square feet, and during heavy rains is so filled with water as to empty every trap connected with it. The water-closet in the bath room was found attached to this pipe, and its trap was so nearly emptied of water that it offered no obstruction to the entrance of sewer-gas. Mr. Rockwell had wash basins in his sleeping rooms and nursery, but the traps do not hold water, so of course the gas had no difficulty in gaining entrance. In fact, if the builder had desired to turn his house into a hospital and furnish his own patients, he could not have devised a better system of defective plumbing.

That diphtheria should prevail in this locality is not strange. At times the streets are strong with sewer stench, and the houses so offensive that it is next to impossible to remain in them. The sewers there drop almost perpendicularly to Furman street—a fall of 50 feet. There being no traps, there is a clear channel for the gas from the sewer. If on its way up the pipes the gas finds an opening, it naturally avails itself of it, and soon obtains access to the sleeping departments. While all the houses are open to this criticism, the splendid mansion occupied by Mr. Rockwell's family appears to be about the worst in its plumbing details. That the gas did obtain an entrance in his house is evidenced by the sad results. An extraordinary feature of the inspector's report is the mention of a large tank which supplies water to the upper floor—water which the servants drink. An analysis showed that the water contains a large amount of organic matter, and is utterly unfit to drink. Its overflow pipe connects directly with the soil pipe, and as there is no intervening trap, it would be difficult to suggest a better way for rendering the water malignantly offensive.

The report has worked up Brooklyn to a fever heat. Had it been shown that Furman street, or any other of the older streets the other side of Fulton street, were badly sewered, it would not have excited much surprise; but to find the homes of the "first citizens" at the zenith of disease and the centre of foulness, was such an unlooked for discovery that the "boldest hold their breath." And well they may, for sewer-gas is not especially healthful.

The Board of Health has taken hold of the Rockwell house, and the plumbers will have a fresh opportunity to show how much they can do and charge for. The pipes along Pierepont Place (where a beautiful park, formerly a part of the Pierrepont farm, borders on the yard of Simeon B. Chittenden) have been blown out, and Columbia Heights is to be thoroughly overhauled and put in order.

[Official Report.]

THE NINTH ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Held at Boston, Feb. 19, 1879.

The Annual Meeting of the New England Association of Gas Engineers was held at the Tremont House, Boston, on Wednesday, Feb. 19, 1879, and was called to order at twenty minutes past twelve by the President, Samuel G. Stiness, Esq.

On motion of Mr. Dwight, of Springfield, Mass., the reading of the minutes of the last annual meeting, and also of the semi-annual meeting, was dispensed with.

The President—There is quite a number of our friends who are assembled with us upon this occasion who are not gas engineers, but who are connected so immediately with the manufacture of gas that I have no doubt they will be pleased to sit in our convention. Is it the pleasure of the Association to take any action in this regard?

We have with us to-day one who is well known to the gas fraternity throughout the United States—a gas engineer of ability, representing one of the Southern States—Mr. Theobald Forstall, of New Orleans, La.

Mr. Cushing (Lowell)—I move that Mr. Forstall be invited to take a seat with us.

The motion was unanimously adopted, and Col. Armington, of Brooklyn, and Mr. Cushing, of Lowell, were appointed a committee to present Mr. Forstall to the convention.

Mr. Cabot—Before that committee retires, I would suggest that we take action also with regard to the cases of several other gentlemen whom the convention would be glad to honor in the same manner.

The President—The opinion of the Chair is that Mr. Forstall should be presented alone, and the others afterward.

The Secretary—At a meeting of the Directors the President and Secretary were authorized to invite such persons as they saw fit to unite in the meetings of the Association, but I have thought that it would be well to extend a special invitation to Mr. Forstall.

The committee last appointed then retired, and returning with Mr. Forstall, presented him to the convention.

The President—I have the pleasure of presenting to you our distinguished guest, Mr. Theobald Forstall. He has never had the opportunity of meeting with this New England Association before, but we have well know him through his management of the works over which he has charge, and also through the public press, and we hope to be favored with the knowledge that he is capable of giving us during the session of the convention. We doubt not that his visit will be one of pleasure to himself as well as of great profit to us.

Mr. Forstall—I thank you very much, Mr. President, for your kind words. I will say that I came to Boston to listen, and not to make myself heard. I was not prepared for any such reception as this. I merely came here expecting to sit in a quiet corner and hear what was going on in the New England Association of Gas Engineers.

[To be continued.]

Lead Poisoning at Portsmouth.

Staff Surgeon C. J. Fenwell, of Portsmouth Dockyard having reported to Rear-Admiral Foley, the admiral superintendent, that during the past year there had been no fewer than 75 serious cases of lead poisoning in the yard among men engaged in cleaning the double bottoms of men-of-war, exclusive of the number of cases that occurred in the Indian troopers, experiments have been made upon the double bottom of the "Devastation," with the object of ascertaining whether the processes now in use of chipping and cleaning the old red lead could not be dispensed with. The experiments have been conducted by Mr. W. B. Robinson, chief constructor; Mr. J. Elliot, constructor in charge of the ship; and Mr. Weston, admiralty chemist.

Hitherto the most stringent regulations have been issued for the information of the workmen, but without effect, owing, no doubt, in a great measure, to the difficulty in carrying them out practically. To preserve the iron of the double bottoms from deteriorating, the iron surfaces are coated in red lead, which requires to be periodically renewed. But before this can be done the old coating has to be removed, which can only be accomplished by chipping and scraping, whereby the poisonous pigment, converted into an impalpable powder, is inhaled by the workmen. To prevent the serious results of lead poisoning, and the introduction of the dust into the skin, the utmost attention to cleanliness is necessary. The shipwrights are accordingly advised to wash the face and hands, rinse the mouth, and comb the hair several times a day. Bathing and ablution of the whole body should also be frequently be practiced. The working clothes, which should be made of canvas instead of woollen material, should be washed at least once a week, and worn as little as possible after coming out of the ship, while the head should be protected by a cap made of some impervious substance, such as oiled paper. Care should be taken that none of the poison be admitted into the system with the food. The workmen are cautioned against taking their meals where scaling has been going on, and are advised to be scrupulous in cleaning their hands and lips before eating. They are also requested to use muslin covers for their mouths, to take plenty of fat or oily food at meals, and to use a sulphuric acid orangeade as a beaverage. The impracticable nature of many of these regulations has led to their being generally neglected, with the consequences already mentioned.

The first experiment on board the "Devastation" was with a view to determining whether the old red lead could not be removed without the necessity of being chipped off, and it was found that the ordinary "cleansing powder" used in the yard, mixed with sea water, and applied with a brush, softened the lead to such an extent that it could readily be scraped off like moistened putty, without any portion being dispersed in the form of powder. The subsequent experiments with the purpose of discoverimg whether red-lead paint could not be superseded as a protective for the iron by a non-poisonous composition. The requirements to be met were that the new protection should not be rendered inoperative by wet surfaces, and that it should dry almost immediately These requirements were (according to the *Morning Post*) successfully fulfilled by a treatment of Major Crease's, of the Royal Marine artillery. A black composition is first applied to the iron, and, being a water paint, it is not affected by wet, after which a coat of specially prepared cement is put on, which combines with the composition and forms a stoney enamel, which effectually secures the double bottom from oxidization. It was found that the coating dried in four hours, and it is understood that the cost is less than that of the poisonous process which has hitherto been adopted. The constructive department at Portsmeunth has strongly recommended the new reatment to the Admiralty.—*The Builder.*

The Apollo Concert—Electric Light.

The repetition of the third concert of the present season by the Apollo club was enjoyed by the usual large audience of associate members and their friends at Music Hall last evening. There was a marked improvement in the work done by the club as well as that of the assisting instrumental performers, and the programme proved far more enjoyable than upon the occasion of its first rendering on Wednesday evening of last week. Two vocal numbers were repeated in response to genuine applause, the Lux, "Drinking Song," and the English glee by Evans. Of the instrumental numbers the scherzo from the Hummel septet was again the most pleasing, though the andante was played in far better manner than last week. The new electric light recently introduced into the hall was used for the first time, and proved anything but a success. At first the five electric lights were used alone, but before the club came upon the stage the gas was added to the light, about half the full blaze of the burners being used. This produced a sickly yellow light, disagreeable to the eye as well as injurious to the sight. Whenever a pianissimo passage occurred some one of the lights would be heard hissing and spluttering like an overgrown tea-kettle in a fit of desperation, and the light was given to the same flickering that was noticeable at the Mechanics fair early in its career. At the close of the first part the electric lights were turned out by order of the officers of the club, and their expiring splutters were greeted by a hearty round of applause from the balconies, whose occupants had suffered most from the evening's experiment.—*Boston Herald.*

Gas Lighting.

In a recent article on gas-lighting we observed that the comparative inefficiency of street lighting in London had been brought into unpleasant prominence by the appearance of the electric light in our midst, and we pointed out that that inefficiency was due to the fact that the lamps were placed too far apart, and that the supply of gas to them was too small, the consumption being kept as low as possible by the Vestries from motives of economy. That these shortcomings were not due, as some had begun to imagine, to the impossibility of obtaining a better light from gas, except at a prohibitory cost, was shown by the particulars we then gave of the experimental lighting of a portion of the Waterloo-bridge road with gas, on a liberal scale, by the Phœnix Gas Company.

This was practically intended as an answer to the experimental lighting of the Holborn Viaduct and the Thames Embankment by electricity, and although the cost of illumination was certainly increased under the improved system of gas lighting, it was not increased unduly or extravagantly. A similar answer has now been given by the Gas Light and Coke Company, who, having obtained the sanction of the St. James Vestry, have now revolutionized the gas lighting of Waterloo place and a part of Regent street at their own expense. The gas light company some little time since appointed a committee of their directors to take action in this direction, and they placed the matter in the hands of Mr. Wm. Sugg, of Westminster, to carry into effect, and he has very successfully accomplished their wishes. The arrangements were completed yesterday, and the lighting up of the whole series of lamps took place, for the first time, last evening, a number of gentlemen interested in the question of public lighting being present upon the occasion.

The ordinary lighting of this piece of roadway, which is about 500 yards in length, and of considerable width at the lower end, is effected by means of 42 lamps, burning 2½ cubic feet of gas per hour, and the light from each was equal to 9 candles. Thirty-six of these lamps are on the footways, four on the street refuges, one between the Atheneum and the United Service club houses, and one opposite the County Fire Office. There were therefore 105 cubic feet of gas used per hour in these lamps, which, being cannel gas, costs 4s. 4d. per 1,000 bubic feet, and amounts to 5½d. per hour. There are also several lamps attached to the Guards' Memorial, but owing to their special construction they had to be excluded from the experiment. The 36 footway lamps have had the old lanterns and burners removed, and they have been replaced by new lanterns, specially designed by Mr. Sugg, and his London argand burners, having two concentric columns of flame. In each of these the consumption of gas is 19 cubic feet per hour, and the light produced is equal to 80 candles. In four instances the ancient lamp posts have been superseded by others of modern construction, designed by Mr. Sugg, and which have several structural features below as well as above ground to recommend them. The four lamps on the refuges have the improved lanterns, and are now fitted with London burners, having three concentric columns of flame, each burner consuming 23 cubic feet of gas per hour, and affording the light of 109 candles. The two improved lanterns on the standards between the Atheneum and the United Service clubs have the same kinds of burners, but with four concentric flames, consuming 45 feet of gas per hour, and giving a light equal to 200 candles.

The lanterns are of a similar pattern to those used in the Waterloo road, which, with the burners, were also supplied by Mr. Sugg. In vertical section they approach the diamond shape, and are hexagonal in plan, with the exception of the two largest and the four of intermediate size, which are respectively 12-sided and octagonal. The upper portion of each lantern is glazed with a new kind of white glass, which serves to reflect as well as to transmit the light. The lower portion is of clear glass, which allows the reflected as well as the direct rays to be distributed around; and such is the arrangement of the framing that no shadows are thrown on the ground immediately under the lantern, as with ordinary street lanterns.

The ventilation of the lantern is very perfect, and is such that a high wind does not effect the steadiness of the gas flame. The burners are so arranged that they are self-lighting upon the gas being turned on. To effect this each burner is fitted with a jet of gas termed a flash-jet, which burns a quarter of a cubic foot per hour, and always remains alight. This little jet is maintained at a constant rate of consumption by a small governor of very ingenious construction, which Mr. Sugg has recently devised. Each of the large burners is also provided with a governor, so that variations of pressure in the street mains do not in the least effect the height of the flame. Each lamp is provided with a lever tap, so arranged that the gas can be turned on and off without the use of a ladder. When turned on the small flash-light ignites the gas, and when turned off the "flash" remains burning, there being thus no necessity for opening the lanterns to light the burners, notwithstanding that they are of the argand type, with chimneys.

With regard to the cost of the gas for the improved system of illumination, it will be observed that the 36 footway lamps, at 19 feet each, burn a total of 684 feet per hour; the four refuge lamps, at 23 feet each, 92 feet per hour; and the two large lamps, at 45 feet each, 90 feet per hour. This gives a total of 866 feet of gas per hour, affording an illuminating power of 3,680 candles, and costing, at 4s. 4d. per 1,000 cubic feet, 3s. 6½d. per hour. This is, of course, a marked increase upon the 105 cubic feet per hour consumed by the 42 old lamps, and costing only 5½d. per hour. But equally marked is the advance in the illumination, which is of the highest character.

During the progress of the work of modification temporary burners were used. These were Sugg's London burners of a smaller size, consuming 6 feet per hour, and of 6-candle illuminating power. This lighting was of itself a very great improvement upon the system it superseded, but was of course inferior to that by which it has been succeeded. By it (the intermediate arrangement) an approximately efficient light could be obtained at a cost of 1s. 1½d. per hour for gas, larger burners being used on the refuges and in the open spaces. As in the case of the Waterloo

road experiment, the new system is not intended to be applied indiscriminately (unless desired) but is an example of what might be done during certain hours of the night in our leading thoroughfases and at the intersection of roads where the traffic is heavy. It is to be observed that the cost of lighting the 500 yards of road in Waterloo place, as exemplified last evening, is considerably in excess of that of the 500 yards of the Waterloo-bridge road, But then the illumination is greatly superior in the former case, and, in fact, may be taken as the perfection of street gas lighting. A few private burners on the route which were still lit formed a negatively admirable contrast to those of the new type, wile the lamps surrounding the Guards' Memorial were simply ludicraus in their eeble effect.

There are three results now afforded, and these are —first, those of the Waterloo place experiments, as explified by the present system of lighting, which affords a very high rate of illumination, and which costs, for gas, 3s. 6½d. per hour; secondly, those of the waterloo road experiment, where the cost is 1s. 7d. per hour; and thirdly, the intermediate system temporarily applied in Waterloo place by Mr. Sugg during the transition period already alluded to, and in which the cost of gas was 1s. 1¼d. per hour. These three degrees of excellence form examples of what can be done with gas, and they illustrate the value of these experiments, inasmuch as they point out that any desired degree of illumination can be obtained from gas, and that it is only necessary for a Vestry or any other public body to say what amount of light they are prepared to pay for, and they can have it. There was only one exception to the perfect harmony of the whole proceedings last evening, and that was that one of the old lamp posts broke down when being lighted, and the attendant barely escaped a bad fall. Otherwise there was no drawback whatever to the exhibition of an unprecedented amount of warm light, which forms an epoch in the history of street lighting, and which is alike creditable to the spirit of the gas company that initiated the experiment and to the skill and ingenuity of the gentleman who carried it out.—*London Times, Jan.* 2.

Compensation for Professional Advice.

The *Plumber and Sanitary Engineer* for February has the following article, which applies to many things besides the cases mentioned:—

It is difficult to conceive of anything that is more reluctantly paid for than professional advice, unless it be the traditional "dead horse." Lawyers and physicians have in a measure educated those not of their profession into the conviction that, if not right, at least it is necessary to pay for advice obtained regarding the best method of protecting property or health, as the case may be. But architects and engineers have yet to be so fortunate. The non-architect public attain this branch of education far too tardily for their own welfare, as daily experience shows. They do not distinguish between the designer and the mere mechanic who carries out his design, though they are certain to make this distinction in their own vocation. The merchant pays more liberally the salesman who negotiate a sale of a thousand barrels of flour than the truckman who performs the manual labor of delivering them; and the salesman is the designer of this operation, and the truckman the mechanic who executes it. The service of the one is, in its nature, intellectual, and of the other manual. Carry the simile further, and we may contrast the architect and the builder. The former is the designer, and performs intellectual service, and the latter, either in person or by his employees, renders simply manual service, and out of his business utterly ignores this principle. Having gained a competence in the peculiar exercise of his intellectual faculties, he resolves to erect a mansion which shall both yield comfort and display taste. How to attain these results, and with economy, he is at once convinced are questions he cannot solve. He is forced to seek the advice of one who, by a long course of study and practice, has fitted himself to render it. He acts upon it, and, we may assume, to his advantage. The builders and the laborers are paid, but the unfortunate architect is often looked upon as a most presumtuous fellow if he expects to be compensated for his advice.

The merchant is willing to pay for services rendered in the shape of payments for drawings, but advice he cannot recognize as a service. Had the architect superintended the carrying out of his plans, that would have been a service; but his ideas simply should not be the subject-matter of compensation. And the merchant's reasoning, condensed, is: the ideas are worth carrying out, but not worth paying for.

If this reasoning be correct, then must the architect abandon his profession, and the merchant be deprived of the benefits of his art—an alternative not to be desired. The professional man employs his time in skilling himself in his particular art or science, to the exclusion of other avocations, and is therefore dependent upon it for support. The knowledge he ultimately attains is his capital equally with the merchants credit or dollars invested in his wares; and when he speaks from his storehouse of knowledge he operates with his capital, and has an equal right to a profit on his peculiar transaction as the merchant has to his. What is worth having is worth paying for; and the elements which enter into the value of a manufacture are not alone material and labor. They are all important, but not more so than than that other element, design, which, carried out, performs its function in ministering to our necessities and comfort.

American *v.* English Locks.

Mr. Jas. Hill, of Upper Thames-street, says, in a letter to Col. Wrottesley, published in the *Times*:—

"With respect to my own particular trade, I used to buy the bulk of my locks from Willenhall. I am not exactly a manufacturer, although I have locks of my own patterns made exclusively for me. I prefer to be a merchant only, as I should be sorry to have direct dealings with the British workman. I still buy a little from Wolverhampton and Willenhall, when time is of consequence; but my chief supply comes from America. I was driven there by the inferiority and high prices of English workmanship, and the unwillingness of the masters to entertain my ideas of improvement. The latter are now complaining of my American resources. I have supplied all the locks for a large hospital at Walsall, within a stone's throw of where locks are made! Yet these locks of mine came 3,500 miles, and cannot be equalled in this country. This is sending 'coals to Newcastle' with a vengeance! I have certainly reason to rejoice that I visited America last year. I opened up business relations with one or two large firms, who have taken pains and spared no expense to carry out my views in relation to much-needed improvements in the sym metry and construction of our English locks. You ask me to state the results of my observations in America, and the causes operating in favor of American productions being cheaper and botter than the English. In the first place, the Americans certainly employ machinery a great deal more than we do. Indeed, the bulk of our English locks are hand made, and there is too much of the 'rule of thumb' about them. Secondly, the Americans, both masters and men, seem to have more technical and general education than we can boast of here. We do not think enough in our manufactories, whereas it would pay us to keep a man to do nothing but invent and improve and think out the requirements of our customers. In the third place, the men work longer hours in America, and I was surprised to find that they worked as long on Saturdays as on other days. Fourthly, I found less drunkenness in America, and I certainly could not hear that the men neglected their work through drink."—*London Builder.*

Improved Method of Lighting Passenger Railway Cars.

THE FOSTER COMPRESSED GAS GOVERNOR.

The last number of the *National Car Builder*, an excellent authority on this subject, says that "all the efforts that have been made to devise some effective means for the lighting of passenger cars have thus far failed to meet one of the essetial requirements—the furnishing of a light sufficiently strong to enable passengers to read ordinary print in any part of the car. . . . What is wanted is a good light at a cost that will permit of its being used in all passenger cars."

It is highly probable that this want will be supplied by the successful operation of the Foster Compressed Gas Governor, in removing the obstacles that have heretofore prevented entirely satisfactory results in the use of compressed gas. It is reported that the German railroads, after a prolonged trial of numerous devices, have recently adopted compressed gas as the best attainable material for lighting passenger cars. A similar conclusion was reached a few years ago by the Pennsylvania Railroad Company, and Mr. Foster's invention will probably overcome all well-grounded objections to the introduction of compressed gas in the cars of all the important steam railway companies of this country. The same reasons that make gas preferable to candles and illuminating oils for use in private dwellings apply to the lighting of cars. But difficulties analogous to those which prevent the introduction of gas into remote country houses formerly existed; and now they have been overcome.

The first great step toward the attainment of this advance was gained by the construction of pumps which compress comparatively large quanties of gas into tanks of such small size that they can be conveniently carried underneath passenger cars. This compression has been performed, in an entirely satisfactory manner, at the Altoona shops for several years, and everything relating to the machinery of pumps and pumping engines requisite has been so thoroughly perfected that it will hereafter be an easy task for any gas company in the country to supply tanks of gas to railway companies. In practice this new illuminator has been advantageously used on the passenger cars of the Pennsylvania Railroad Company for several years, and the main obstacles to its unqualified success were those which arose from the fact that the arrangements for providing for the outflow of the gas were not entirely sarisfactory. At times there has been too great or too small a pressure at the burning point. To overcome this difficulty Mr. J. M. Foster, of Philadelphia, after long and careful study and protracted experiments, patented, on Nov. 26, 1878, the Foster Compressed Gas Governor, which, during a trial of six or seven months on cars making night trips between Philadelphia and New York, has given great satisfaction. It automatically regulates the outflow of gas so thoroughly that there is a uniform pressure at every burner, while the gas in the tanks is dwindling down from the full supply they usually contain until this supply is exhausted; or, in other words, the pressure at the burning point is uniform, while the pressure in the tanks may vary from five pounds to three hundred pounds to the square inch. We have not space here to decribe the mechanical devices by which these important results are accomplished. It is sufficient to say that the Automatic Compressed Gas Governor seems to fulfill all the necessary conditions. It occupies a comparatively small space, can be readily attached to any tank, and does its work so thoroughly that the desired results are fully attained. It is claimed that by its use, with gas at $2 per thousand cubic feet, a car can be lighted with a brilliancy equal to that furnished by about 60 standard sperm candles, at an expense for gas of about 4 cents per hour; or that a brilliancy equal to about 45 candles can be obtained at an expense of 3 cents per hour.—*Railway World.*

THE AMERICAN GASLIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

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PHILADELPHIA—PRATT & Co., Corner 9th and Arch Streets.
Germany—B. WESTERMANN & Co., of New York.

MONDAY, MARCH 3, 1879.

The Part Played by Coal Dust in Producing Explosions in Mines.—L. Simonin.—The author demands permission to make known certain facts which prove that it is in the majority of cases the heating of the coal dust diffused in the galleries of the mines to which explosions are due. Referring to the catastrophe in the Jabin Mine at St. Etienne (February 4, 1876) he states, on the authority of the manager, that the mine in question contains very little fire-damp, and that the precautions hitherto taken with an exclusive reference to that gas are not sufficient. Others must be taken against the extremely fine coal dust, which at the moment of the explosion of slight amounts of fire-damp, or even of blasting powder, liberates rapidly a part of the coal-gas which it contains, and propagates the explosion, reproducing the cause of the evil with so much the greater energy as the current of air is more violent. Thick crusts of coke (2 or 3 centimetres) prove this fact and explain how it is that extensive tracts in which fire-damp has never been observed are burned like the rest of the workings. Hence, it appears that the precautions to be taken in fiery mines are complex whenever the coal dust is rich in gas and very finely divided. Explosions may then ensue even in mines where fire-damp is unknown. There is no need to suggest the existence of cavities full of carbonic oxide, or of gaseous hydrocarbons, and suddenly laid open by a blow from a miner's pick.—*Comptes Rendus.*

[Is not the attempt, recently made in some mines, to screen the coal below ground, a dangerous mistake as calculated to increase the quantity of dust diffused in the air of the mine?—*Ed Chem. News.*]

Siemens and Halske Lamp.—A new regulator for the electric light, produced by the burning of carbon points, is the Siemens and Halske lamp, which may be called a modification of the Serrin type. The two carbons, both upright, are hinged at their lower ends so that they fall toward one another. The necessary distance between their upper extremities is maintained by a rod of some refractory substance interposed between them. This rod is moved in a vertical direction by a lever arm, which, in its turn, is controlled by an electro magnet. The passage of the current through the electro-magnet and the carbons tends to thrust the refractory rod upward and to separate the carbons. If, however, the current becomes too weak, the rod drops, and the carbons approach one another correspondingly.—*Iron Age.*

Correspondence

[We are not responsible for the opinions expressed by Correspondents. Correspondents, in all cases, should sign their communications with their names and address in full—not for publiction, unless desired, but as a guarantee of good faith.—ED.]

Extending the Use of Gas.

MONTGOMERY GAS LIGHT CO.,
MONTGOMERY, ALA., Feb. 10, 1879.

Mr. Editor:—In your editorial in the last issue of the JOURNAL on "Extending the Use of Gas" you remark, "As Americans, we are not usually deficient in 'push;' but in this matter our English cousins have certainly taken the lead of us." I think it could be shown that it is hardly a question of "push;" the conditions of things in the two countries are very different. The English are in a much more favorable position to extend the use of gas than we are. We have many difficulties to contend with and overcome in extending the use of gas in this country that the English gas engineer is seldom troubled with, and from the very nature of things we are obliged to have more "push" even to make ends meet that they have. Let us look at an average English city; how compactly it is built—hardly a foot of ground unoccupied.

The store-keeper, or tradesman, as he is called, lives above his store, one service and meter supplying the whole establishment with gas. What an economical arrangement for the company! Then, where the business portion of the city ceases, the terraces, crescents, and squares begin, which take a service each 26 feet, so that every foot of main is doing its proper amount of work, which means a small productive capital, and consequently cheap gas.

And even nature itself combines to assist the English gas manager, for they cannot "follow the moon" there in lighting the public lamps. The English moon is very coy about being followed, and hides herself most of the time, and, as you know, the conduct of such a moon helps greatly in the retort house. And besides these advantages the strong arm of the government protects the English gas companies in their rights and privileges. Thus they can say to the municipal authorities, "So far shalt thou come, and no further." This sense of security in their vested rights naturally enables them to sell gas cheap, and thereby extend the use of it for other purposes.

The American city is not famed for being compactly built. The *merchant* does not live above his store, but on his own lot outside the city; so that we are fortunate if we get a sevice every 60 feet, which means a quantity of useless main, a large unproductive capital, and consequently dear gas.

We have also to "follow the moon," which means a waste of fuel and retorts while she is being followed. And it would also appear that our gas companies have few rights that others are bound to respect. Our municpal authorties take every opportunity to harass and annoy the companies. They will grant the right of way to lay pipes and manufacture gas to any who like to apply for it. This sense of insecurity, and not knowing what battle they will have to fight next, naturally keeps the companies from selling the gas as cheap as they might, and of course operates against extending its use in the direction you intimate. No doubt the time will come when we will all "know better." It took the English some time to learn how to do it.

Yours respectfully,
JAMES SOMERTILLE,
Supt.

Gas Matters at West Chester, Pa.

OFFICE OF THE WEST CHESTER GAS CO.,
WEST CHESTER, PA., Feb. 20, 1879.

Mr. Editor: In your issue of 17th ult., you state that we sell gas at $2.80 per M. I will give you a few items about our town and gas company which may not be of much interest to you, as we are a small company, and do not make much of a show as gas manufacturers.

West Chester, county seat of Chester County, Pa., 27 miles west of Philadelphia by rail, population about 7,500. Very little manufacturing; centre of a rich agricultural district. Gas company; capital, $625,000, par value of stock $25, selling at $36, divides 10% on par value, nearly nine miles of street mains, 875 meters in service. Year 1878 sold 7,434,000 cubic feet of gas. Yield, per pound of coal carbonized, 5·12 cubic feet; cubic feet sold per pound of coal carbonized, 4·50; average candle power, 16·4, cubic feet of gas purified, per bushel of lime, 6,280. 158 street lamps. Gas company sets and resets lamp posts, puts on heads and keeps them in repair, gratis (town finds material). Our prices for 1879 are—consumption of over 70,000 cubic feet per annum, $2.60 per M; over 50,000 cubic feet per annum, $2.70 per annum; under 50,000 cubic feet per annum, 2.80. Coke six cents per bushel. We furnish all kinds of gas burners, cooking and heating gas stoves, at cost, as also fitting and attention to consumers without charge.

Yours, truly,
L. G. MCCAULEY, Supt.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
24 PINE STREET, NEW YORK CITY.

FEBRUARY 17, 1879.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	*Par.*	*Bid.*	*Asked.*
Gas Co.'s of N. Y. City.				
Central	466,000	50	60	75
Harlem	1,800,000	50	30	50
" Bonds	170,000			103
Manhattan	4,000,000	50	170	175
Metropolitan	2,500,000	100	120	125
" Scrip	$1,000,000		95	100
Mutual	5,000,000	100	65	70
" Bonds, gold	900,000	1000	95	99
Municipal	1,500,000	100	105	115
" Bonds	750,000		95	100
New York	4,000,000	100	90	95
Nothern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	130	135
Citizens	1,200,000	20	60	70
" Scrip	320,000	1000	90	95
Peoples	1,000,000	10	20	30
" Bonds	325,000			95
" Scrip	300,000		75	80
Metropolitan	1,000,000	100	60	65
Nassau	1,000,000	25	50	56
" Ctfs.	700,000	1000	—	90
Williamsburgh	1,000,000	50	80	85
" Scrip			88	92
Kings Co	200,000	100	—	70
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000		60	85
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md	2,000,000	100	95	98
" Ctfs., gold	1,000,000		95	10
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100		80
Citizens, Newark	918,000	50	90	95
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			128	13
Cincinnati G. & C. Co.				190
Derby of Conn	160,000	100	60	80
East Boston, Mass		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind.		100		—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	120	125
Hempstead, L. I.	25,000	100		—
Jersey City	386,000	20	140	145
Jamaica, L. I.	25,000	100		—
Jacksonville, Ill	120,000	50	82	
Lewistown Maine	400,000	100	70	80

Lima, Ohio,.....	60,000	100	—	...
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	—	75
Long Branch.....		20	30	40
New Haven, Conn...		25	136	152
Peoples, Jersey City		...	—	80
" " Bds.				95
Peoples of Albany...	650,000	100	10	17
" Bonds	350,000	1000	—	-
Peoples of Baltimore		25	44	48
" Bonds....			106	—
Plainfield, N. J.....	80,000	100	—	105
Perth Amboy		25	—	95
Rochester. N. Y.....		100	50	60
Toledo, Ohio.....			95	97
Washington, D. C...		20	—	200
Yonkers.....		50	70	80
Woonsocket, R. I....	150,000	100	80	...
Halifax N. S.....	400,000	40	148	150
Hamilton, Ontario...	150,000	40	117½	
San Francisco Gas-Co., S. Fr'isco Cal.			95	95¼
Pittsfield, Mass.....			120	130
Rondout & Kingston			75	80
St. Louis, Missouri..	600,000	50	73	75
Stillwater, Minn.....	50,000	50	—	26
Saugerties, N. Y....	15,000	100	95	100
Troy, Citizens.....	600,000	100	—	60

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Please state in answer size of works, capacity of holder, size and length of street mains, cost of coal at works, number of street lamps in use and their price per year, date of construction of works, and any other information that may seem consistent. Please address **R. H. GARDNER,**
468-2m. Care AM. GAS-LIGHT JOURNAL.

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Advertiser has a good practical knowledge of the business, and can erect Tar and Ammonia Plants with latest improvements. Address, JOHN G. HARVEY,
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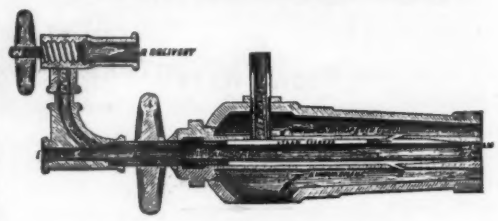
TAR BURNER.



PARSON'S

Combined Hydrocarbon Injector, Steam Blower, and

TAR BURNER.

THIS BURNER HAS BEEN IN SUCCESSFUL OPERATION FOR THE PAST TWO YEARS AMONG THE BEST GAS COMPANIES OF THE COUNTRY.

They can be attached without alteration, and while bench is running.

READ WHAT OTHERS SAY OF IT.

The Tar Burners are doing well, and have met our expectations.
P. T. BURTIS,
Engr. Chicago Gas-Lt. Co.

It is an excellent instrument, and does its work well.
A. HICKENLOOPER,
Prest. Cincinnati Gas-Lt. Co.

Have eight in operation. I am very much pleased with their working. The best burner I have ever used.
A. C. WOOD,
Supt. Syracuse Gas-Lt. Co.

Your burner has given entire satisfaction It is economical and perfectly controllable. The best burner I have ever used.
C. A. WHITE,
Supt. Citizens' Gas-Lt. Co., Rochester, N.Y.

Your five burners are working well.
JOHN B. HARBISON,
Supt. Hartford Gas-Lt. Co.

The Tar Burners are working splendidly.
W. N. WILLIAMS,
Supt. Paterson Gas-Lt. Co.

The Tar Burners are working well.
W. H. PEARSON,
Sec. Toronto Gas-Lt. Co.

Your burner is working well. It is ahead of anything I have ever seen or used.
T. G. LANDSNEN,
Supt. St. Louis Gas-Lt. Co.

Have used Mr. Parson's burners two years. They work perfectly.
JOSEPH GREEN,
Supt. Watertown Gas Co.

AND ONE HUNDRED OTHERS.

We will send them to any Gas Company on trial. If not satisfactory, to be returned.

PRICES:

Burner, $25. Valve, $3. Setting, $2.

Address,

WATERTOWN STEAM BLOWER CO.,

Watertown, N. Y.,

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THE ONLY MINERS OF THE

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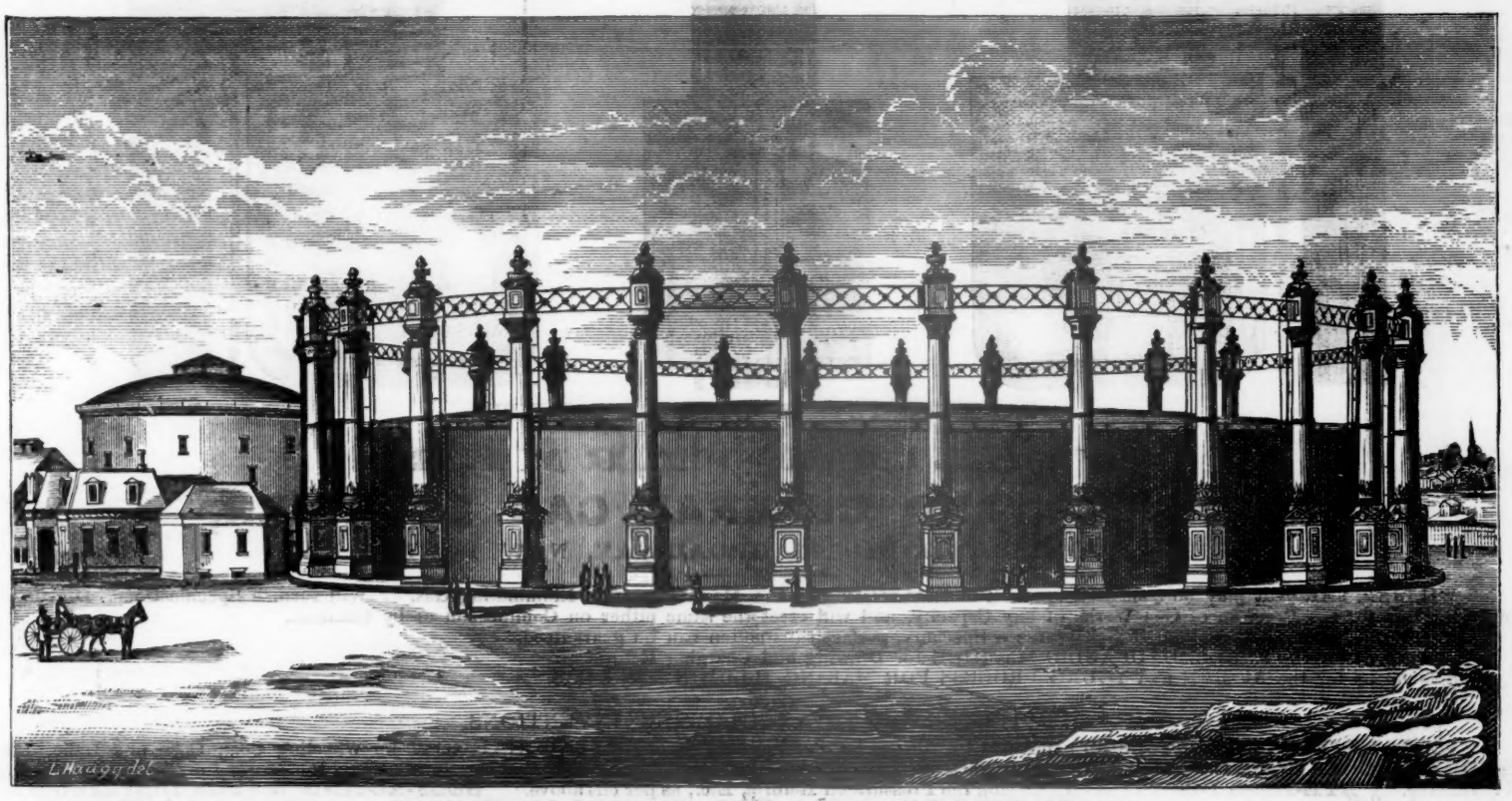

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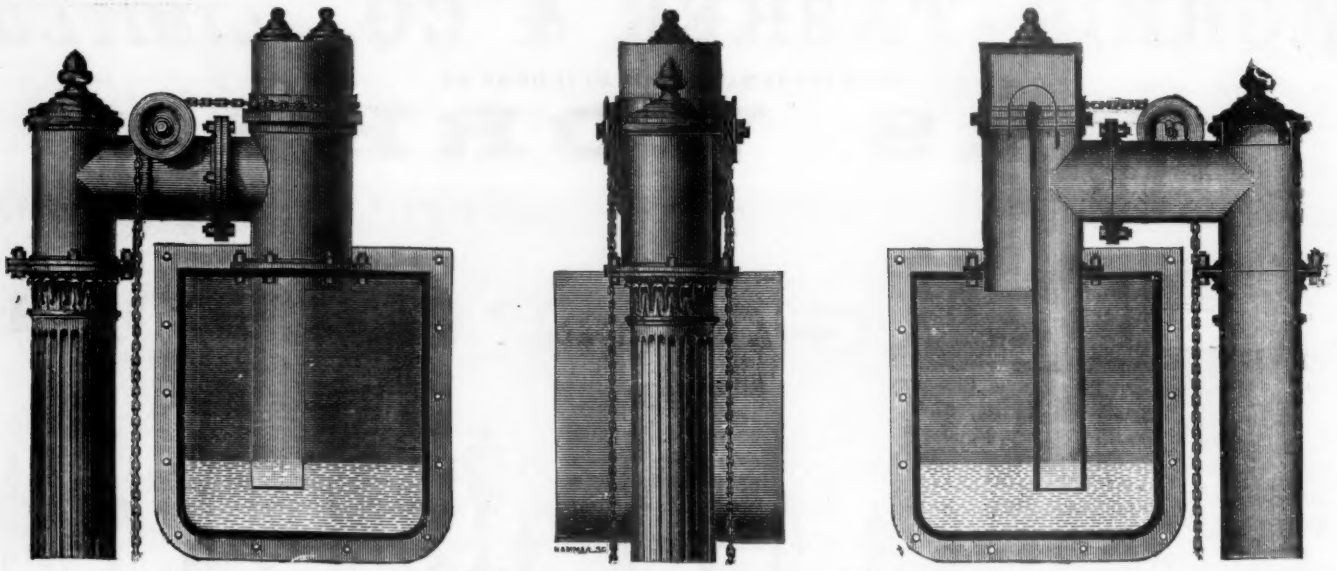

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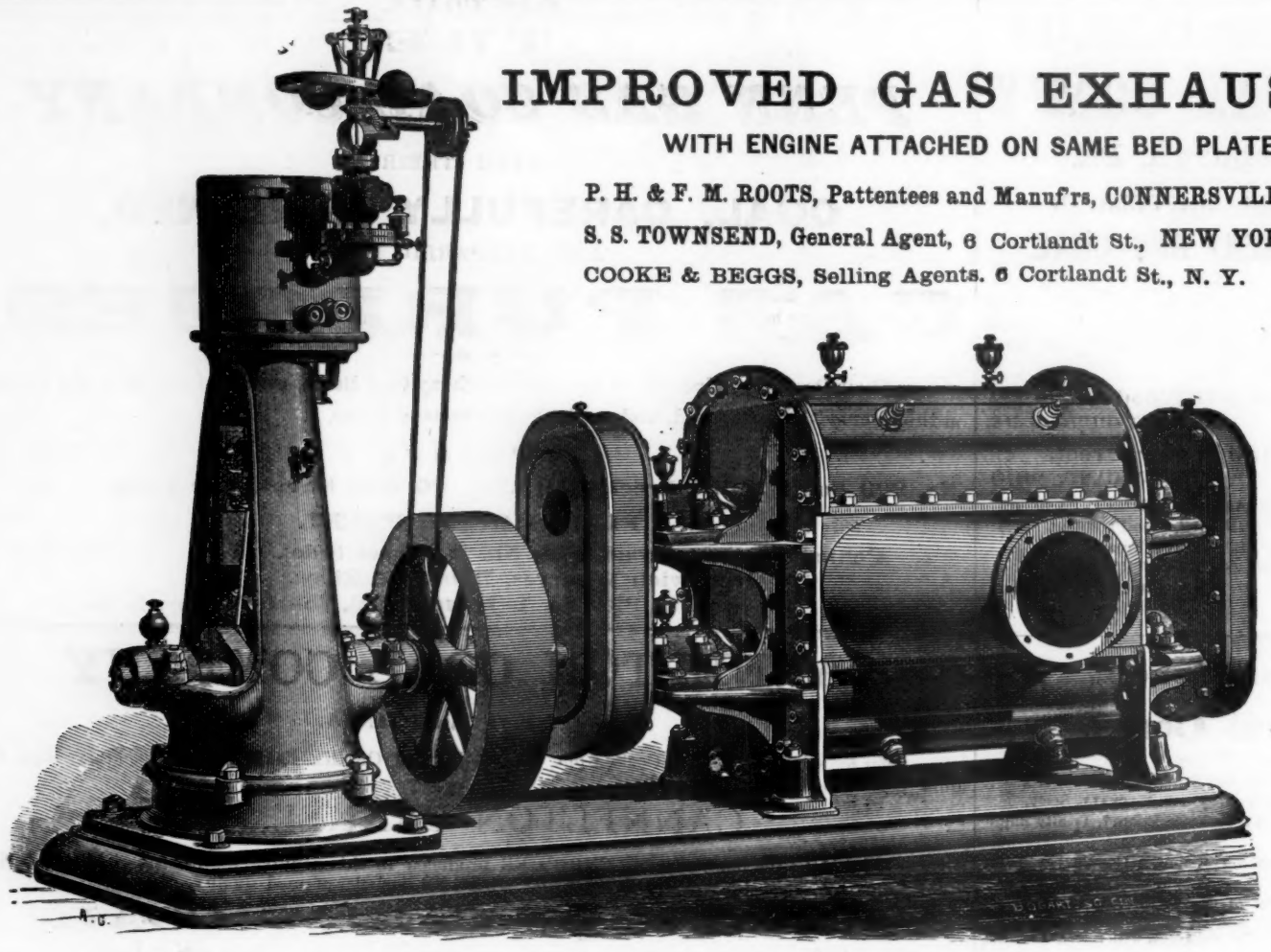

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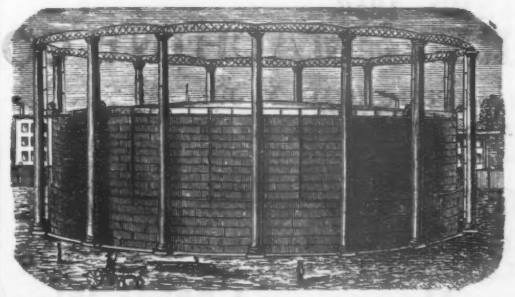

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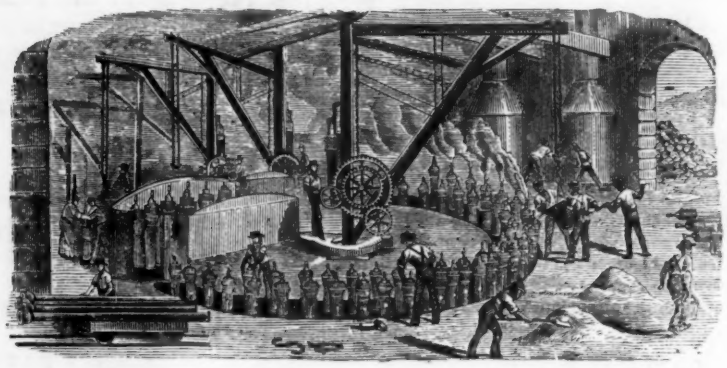

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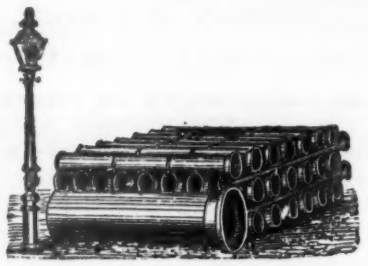

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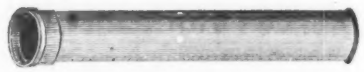

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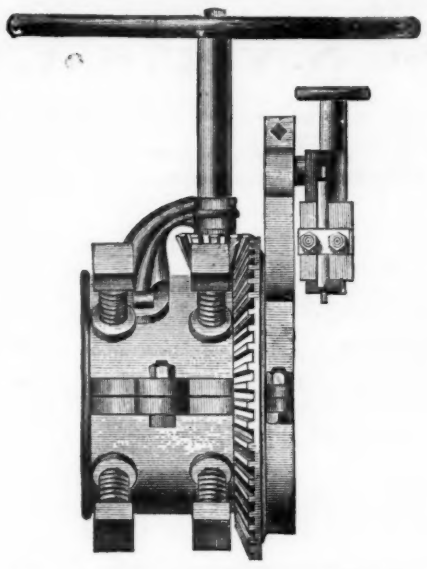

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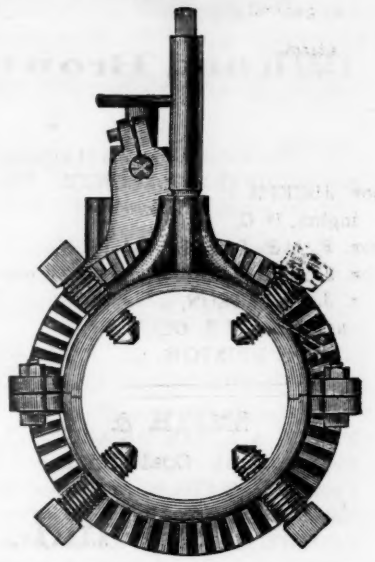

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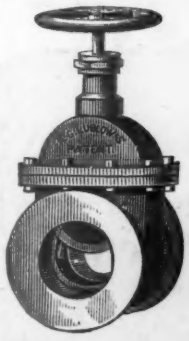

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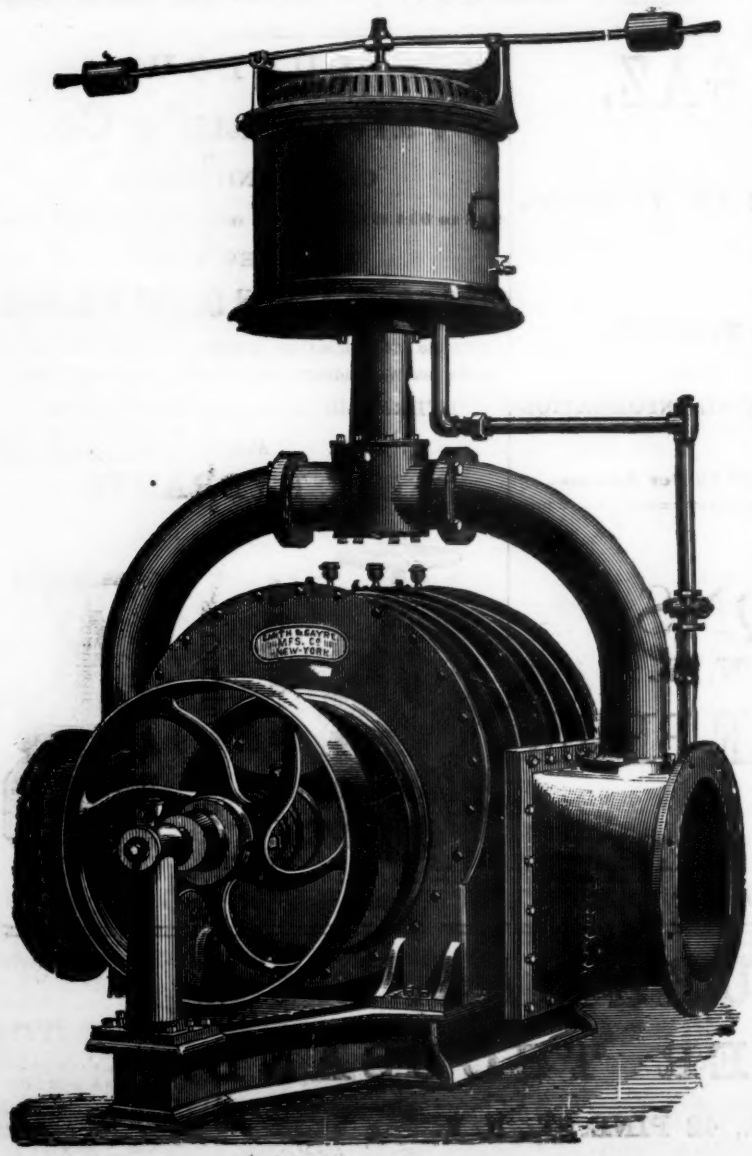

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